Claims

1. A method of controlling a series of photoelastic modulators wherein each one of the series of "n" photoelastic modulators has a resonant frequency and is operable in response to a drive voltage and to a drive frequency, the method comprising the step of tuning the photoelastic modulators during operation of the photoelastic modulators so that the resonant frequencies of all of the photoelastic modulators converge toward a common resonant frequency.

2. The method of claim 1 wherein the tuning step comprises:

separately controlling the drive voltage of each photoelastic modulator; and

providing to each of the photoelastic modulators a common drive frequency.

3. The method of claim 1 wherein each one of the series of photoelastic modulators is controllable to impart a retardation value in electromagnetic radiation that is directed through the photoelastic modulator, the method further comprising the steps of:

selecting a reference retardation value;

separately controlling the drive voltage of each photoelastic modulator;

providing to each of the photoelastic modulators a common drive frequency; and

locking the phase of oscillation of the photoelastic modulators to the common drive frequency so that the sum of the retardation values of all of the modulators matches the reference retardation value.

4. The method of claim 3 wherein the step of providing the common drive frequency is accomplished in part by generating an error signal that includes the sum of the amplitudes of current applied to drive the "n" photoelastic modulators.

5. The method of claim 2 wherein the step of separately controlling the drive voltage of each photoelastic modulator includes the step of adjusting the amplitude of the drive waveform in response to a reference signal that substantially reflects an average resonant frequency of the "n" photoelastic modulators.

6. A system for controlling a series of "n" photoelastic modulators wherein each one of the "n" photoelastic modulators has a resonant frequency and is operable in response to a drive voltage and to a drive frequency, comprising:

"n" local controllers, each one of the local controllers being connected with an associated one of the "n" photoelastic modulators; each local controller including:

a drive waveform generator responsive to a frequency input signal and to an amplitude input signal for generating a drive signal waveform for driving the photoelastic modulator at a drive voltage and a drive frequency;

a phase comparator connected to the drive waveform generator and to the photoelastic modulator for producing a phase error signal based upon the phase difference between the current through the photoelastic modulator and the drive voltage signal applied to the photoelastic modulator; and

a current pickup circuit connected to the drive waveform generator and for producing a current amplitude signal indicative of the amplitude of the current waveform applied to the photoelastic modulator;

a global controller connected to each of the local controllers in a manner to receive the sum of the phase error signals produced by the phase comparators and the sum of the current amplitude signals produced by the current pickups, wherein the global controller includes:

control circuit means for producing a drive frequency signal for controlling the frequency input signal for all of the "n" drive waveform generators and for producing an amplitude signal for controlling the amplitude input signal for all of the "n" drive waveform generators.

7. A method for controlling a resonant photoelastic modulator that is operable in response to a drive signal, comprising the steps of:

controlling the amplitude of the drive signal; and

controlling the frequency of the drive signal.

8. The method of claim 7 wherein the step of controlling the frequency of the drive signal includes controlling the phase difference between the voltage waveform of the drive signal and a current waveform applied to the photoelastic modulator.

9. The method of claim 7 wherein the step of controlling the phase difference between the drive signal voltage waveform and the current waveform applied to the photoelastic modulator includes the step of:

phase locking the drive signal voltage waveform and the current waveform.

10. The method of claim 9 wherein the photoelastic modulator has a resonant frequency and wherein the phase locking step includes the steps of:

comparing the phase difference of the drive signal voltage waveform and the current waveform to discern an error signal based on the difference;

adjusting the error signal; and

applying the adjusted error signal to the drive signal, thereby to enable the photoelastic modulator to be driven at a frequency other than the resonant frequency.

11. The method of claim 7 wherein the step of controlling the frequency of the drive signal includes:

comparing the phase difference between a reference frequency generated external to the photoelastic modulator and the current waveform to discern an error signal; and

applying the error signal to the drive signal.

12. The method of claim 7 including the step of controlling the frequency of the drive signal separately and independently of controlling the amplitude of the drive signal.

13. The method of claim 7 including the step of controlling the amplitude of the drive signal with a feedback signal.

14. A controller for a resonant photoelastic modulator, comprising:

a drive waveform generator responsive to a frequency input signal and to an amplitude input signal for generating a drive signal waveform for driving the photoelastic modulator at a drive current amplitude and at a drive frequency;

a phase comparator connected to the drive waveform generator and to the photoelastic modulator for producing a phase error signal based upon the phase difference between the drive signal waveform and a current waveform applied to the photoelastic modulator; and

a phase-lock loop circuit for receiving the phase error signal and for generating a frequency input signal based on that error signal, and for applying the frequency input signal to the waveform generator.

15. The controller of claim 14 wherein the photoelastic modulator has a resonant frequency that is variable with the amplitude of the drive signal that is applied to it, the system further comprising:

a reference current amplitude circuit for applying to the drive waveform generator an amplitude input signal having a value representing a selected

current amplitude, and for changing the value of the amplitude input signal in response to changes in the selected current amplitude; and

tuning means for adjusting the phase error signal received by the phase-lock loop circuit in response to changes in the value of the amplitude input signal, thereby to account for variations in the resonant frequency of the photoelastic modulator.